

Claims

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1. Electric drive system operated with muscle-power (1) for a vehicle (2) and/or a stationary training apparatus (3) with a foot pedal (5) and a generator (6) mechanically connected with the foot pedal, with an electric transmission (4) from the generator (6) to an electric consumer (10) and/or to a drive motor (11) as well as with an electric control system (20), characterised in that the electric control system comprises a control program (21) of the generator (6), with which a counter moment GM on the generator, related to the forwards pedalling direction v is generatable,
 - wherein the drive system as a vehicle drive with counter moment:
 - comprises a starting control (22) of the generator, with which when the foot pedal is actuated from standstill an immediately occurring pedal resistance TW is generated
 - and with which a high starting moment MA is generated at the foot pedal when starting from standstill up to a minimum riding speed,
 - and wherein the drive system as a drive with counter moment for a stationary training apparatus (3):
 - comprises a motor operation control (23) with a bi-directional converter (31), with which the generator (6) is also operatable as a motor, with controllable coupling and uncoupling of electric power.
 2. Drive system in accordance with claim 1, characterised in that the standstill pedal resistance TW corresponds to an actuation force F on the foot pedal (5) of at least 200 N.

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3. Drive system according to one of the preceding claims, characterised in that the starting moment MA at the foot pedal amounts to at least 40 Nm.
4. Drive system in accordance with one of the preceding claims, characterised in that with the starting control (22) of the generator the starting of the generator is controlled in such a manner, that the starting acceleration of the foot pedal (b_{max}) on average amounts to a maximum of 4 rad/sec².
5. Drive system according to one of the preceding claims, characterised in that the resistance or load moment ($M1$) of the generator is modulated in phase with the pedal angle ($W1$).
6. Drive system in accordance with one of the preceding claims, characterised in that a standstill braking (71) of the foot pedal is active, which produces a standstill pedal resistance TW and which is also effective in case the electric control system (20) is switched off.
7. Drive system according to one of the preceding claims, characterised in that the generator is short-circuitable by means of an electric switch (33) directly or through resistors, capacitors and coils and wherein the electric switch in case the electric control system (20) is switched off is closed for the generation of the pedal resistance TW .
8. Drive system in accordance with claim 7, characterised in that by means of brief switching on and switching off (choppering) of the electric switch (33) during the starting the high starting moment MA is generated.

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9. Drive system according to one of the preceding claims, characterised in that the range of the maximum efficiency of the generator (6) corresponds to a normal range of the pedalling frequency, which in preference amounts to 50 - 100 rpm.
 10. Drive system in accordance with one of the preceding claims, characterised in that the generator control program (21) comprises several moment characteristics (M60, M120), which are able to be changed over between and which increase within a normal range of the pedalling frequency.
 11. Drive system according to one of the preceding claims, characterised in that to the foot pedal (5) and to the generator (6) electrical, mechanical or fluid brakes (45), such as braking resistors, eddy current brakes, friction brake pads, gas - and fluid damping elements or mechanical storage devices (46), such as spring-power storage devices or gas - and liquid storage devices are assigned.
 12. Drive system in accordance with one of the preceding claims, characterised in that a blockable free-wheel system (42) or a switchable clutch (43) is provided between the foot pedal and the generator.
 13. Drive system according to one of the preceding claims, characterised in that the drive system comprises modular units such as a pedal generator module (8) with foot pedal (5), generator (6), a possible speed transmission (7) and generator control system (20.1), a control module (20) and a drive motor module (18) with motor (11), a possible speed

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reduction transmission (12) and a motor control system (20.2).

14. Drive system in accordance with one of the preceding claims, characterised in that electric storage devices (14), and in particular a super capacitor (15) (super cap), are provided as short-term storage devices.
15. Drive system according to one of the preceding claims, characterised in that two differently designed motors, (11a, 11b) each respectively for a higher and a lower speed range, or a motor with switched windings is provided.
16. Drive system in accordance with one of the preceding claims, characterised in that operating data, such as moments or torques, powers and revolutions per minute on the foot pedal are recorded and indicated.
17. Drive system according to one of the preceding claims, characterised in that an interface (35) is provided for the connection of external devices.
18. Drive system in accordance with one of the preceding claims, characterised in that a removable data storage device (29) is provided, which when it is removed carries out a closing function of the system.
19. Drive system according to one of the preceding claims, characterised in that the electric circuit comprises operating programs (24), resp., driving or riding programs (25) for the utilisation in training apparatuses, resp., vehicles.
20. Drive system in accordance with one of the preceding claims, characterised in that the electric control

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system (20) after a selectable time interval, during which no travelling motion takes place, goes over into an inoperative or idle condition and/or the pedal is moved to a desired starting position.

21. Drive system according to one of the preceding claims, characterised in that the foot pedal (5), resp., the muscle-powered drive comprises a changeable geometry.
22. Vehicle with a drive system in accordance with one of the claims 1 - 21.
23. Training apparatus with a drive system according to one of the claims 1 - 21.

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